

Object



We study Workflow modules to model interaction between workflows

Problem

Not all tasks of a workflow net are automatic:
they can be triggered manually or by a message

they can be used to trigger other tasks

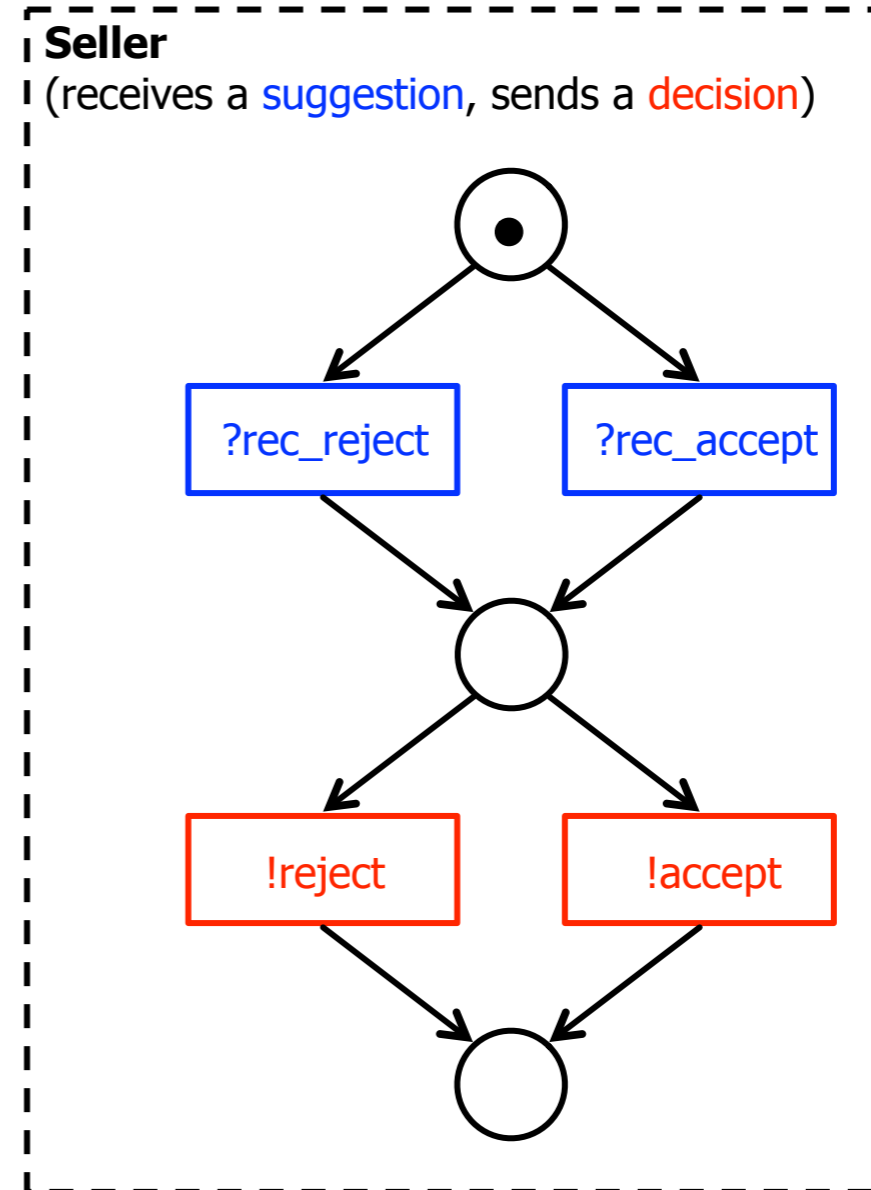
How do we represent this?

Implicit interaction

Separately developed
processes

Some activities
can **input** messages
(symbol **?**)

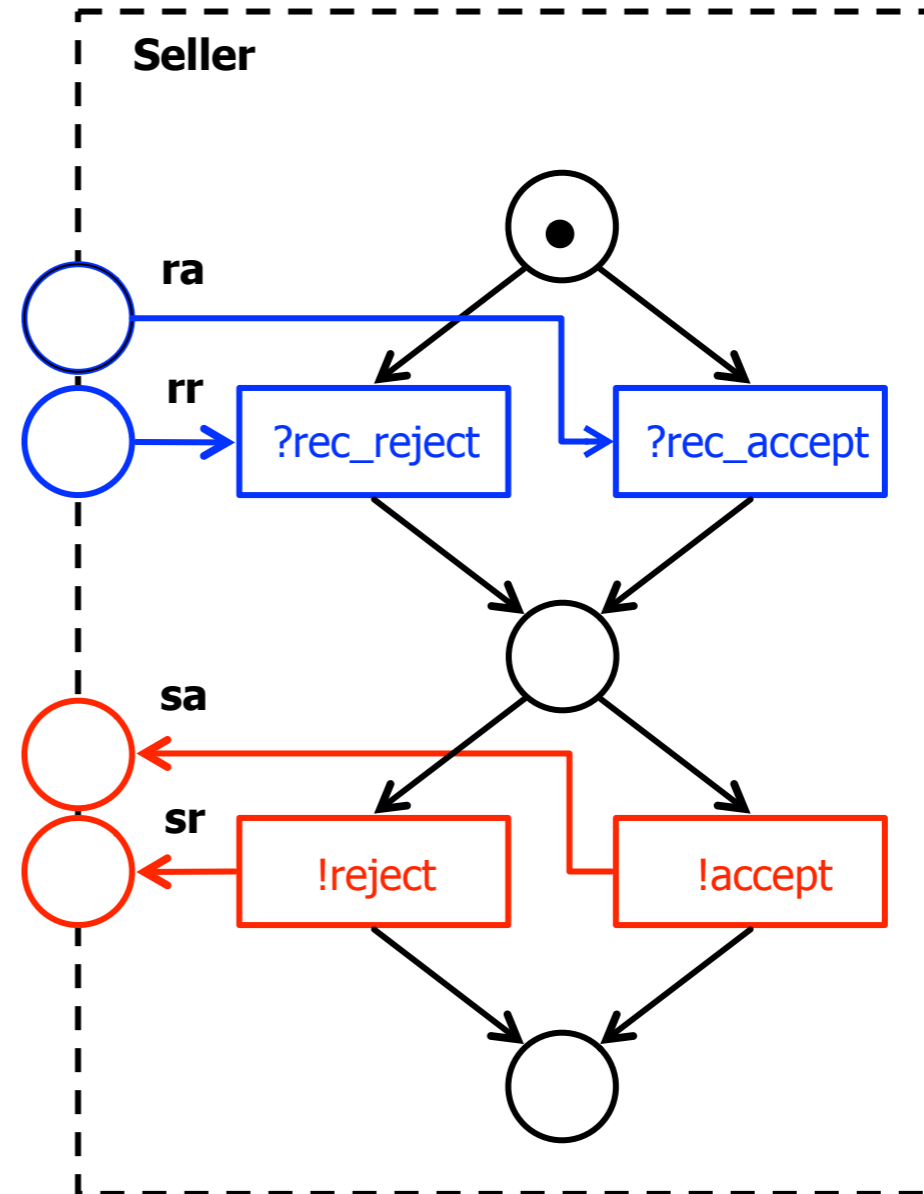
Some activities
can **output** messages
(symbol **!**)



Interface

Seller has an interface for interaction

It consists of some **input** places and some **output** places



From Workflow nets to Workflow modules

Assume the original workflow net has been validated:

it is a sound (and maybe safe) workflow net

When we add the (places in the) interface

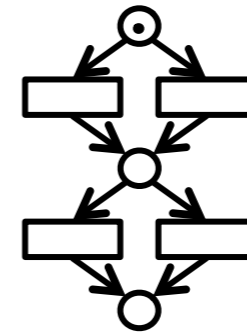
it is no longer a workflow net!

It becomes a **workflow module**

Workflow Modules

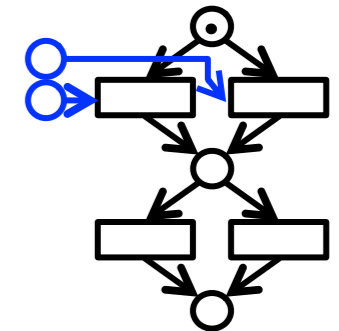
Definition: A **workflow module** consists of

a (sound) workflow net (P, T, F)



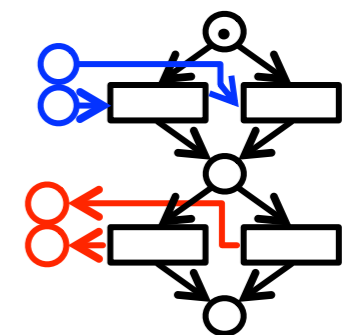
plus a set P^I of incoming places

plus a set of incoming arcs $F^I \subseteq (P^I \times T)$



plus a set P^O of outgoing places

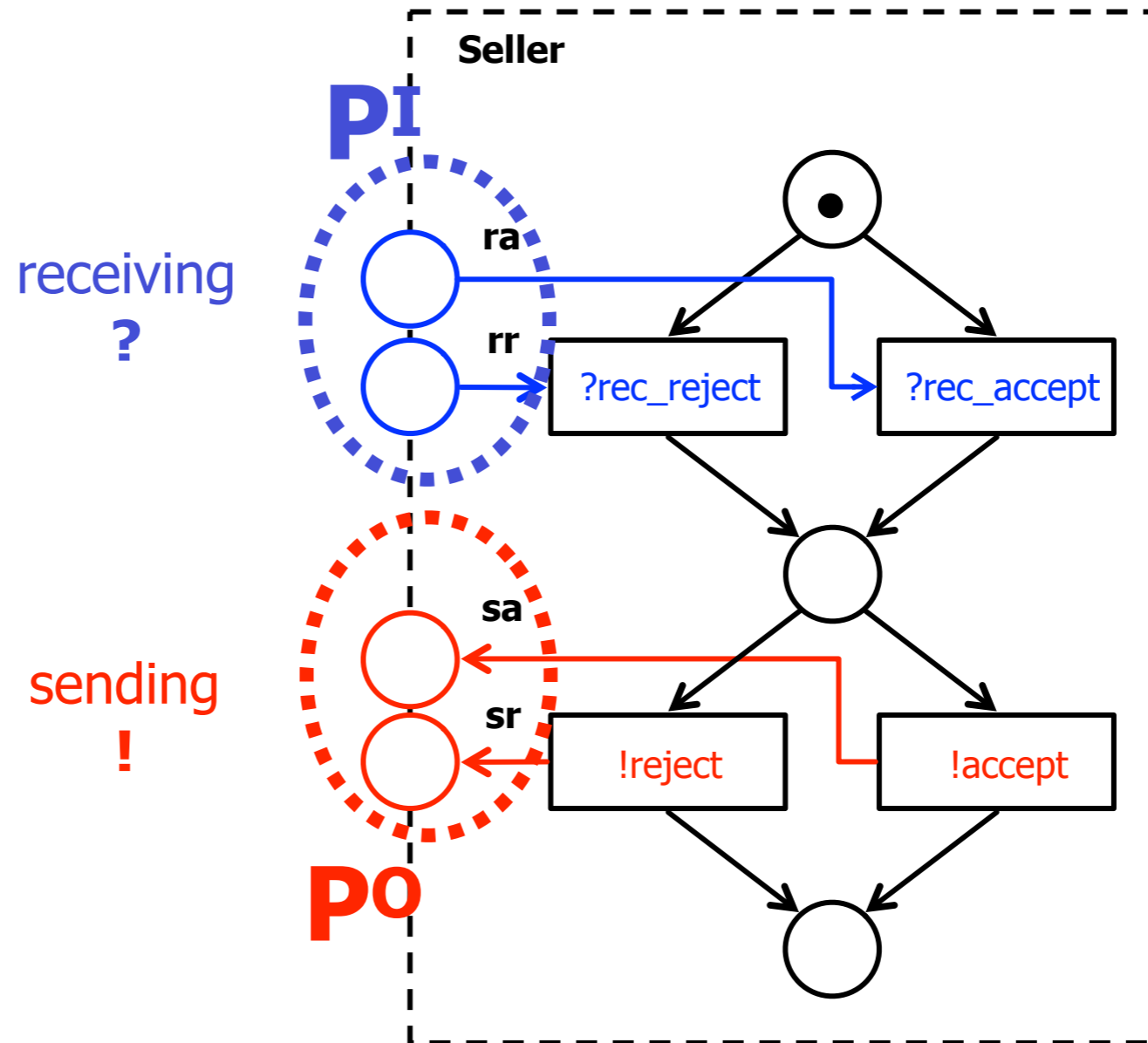
plus a set of outgoing arcs $F^O \subseteq (T \times P^O)$



such that each transition in T has

at most one arc to places in the interface $P^I \cup P^O$

Workflow module: example



Structural compatibility

A set of workflow modules is called
structurally compatible

if

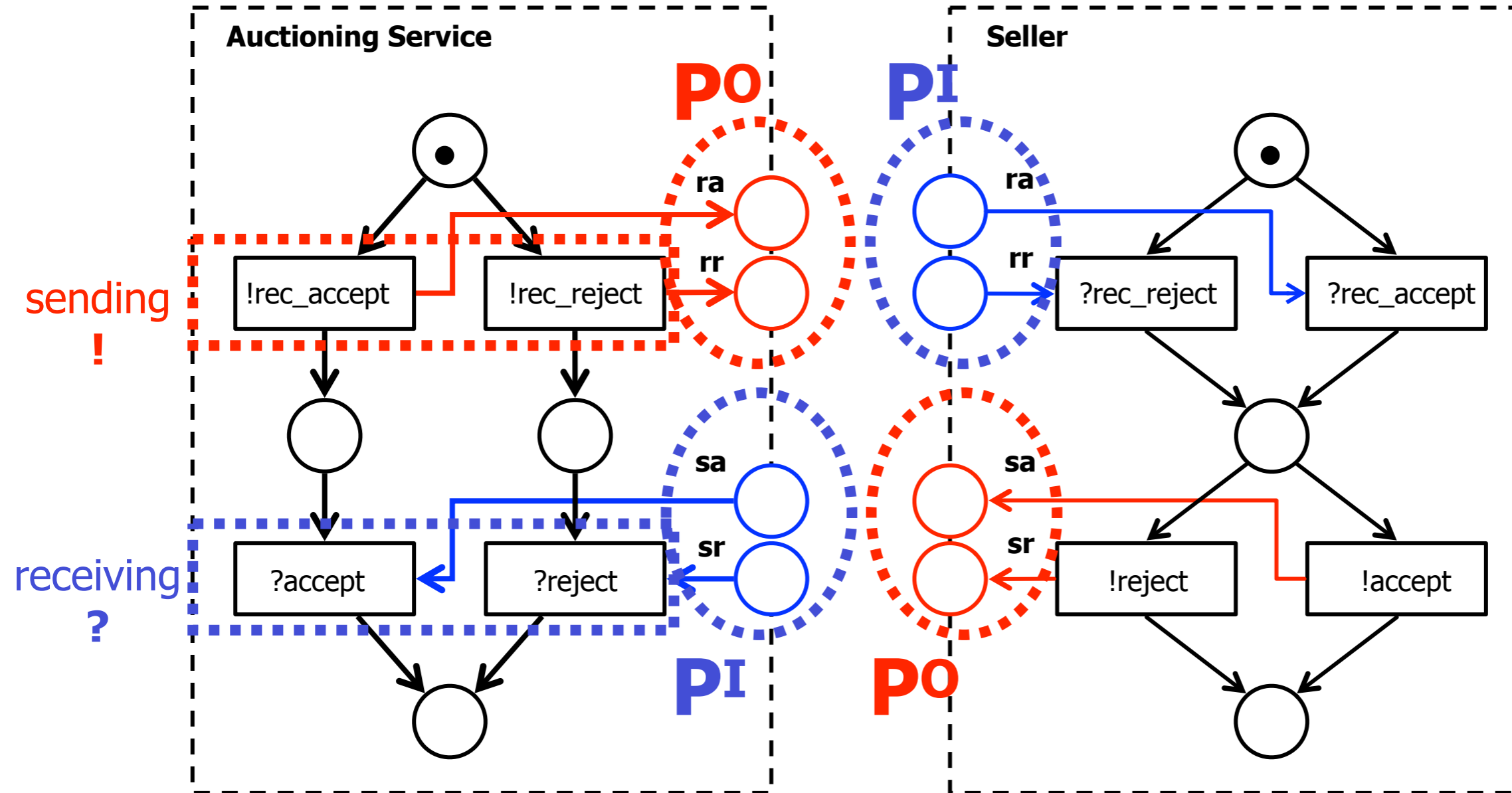
for every message that can be sent
there is exactly a module who can receive it,

and

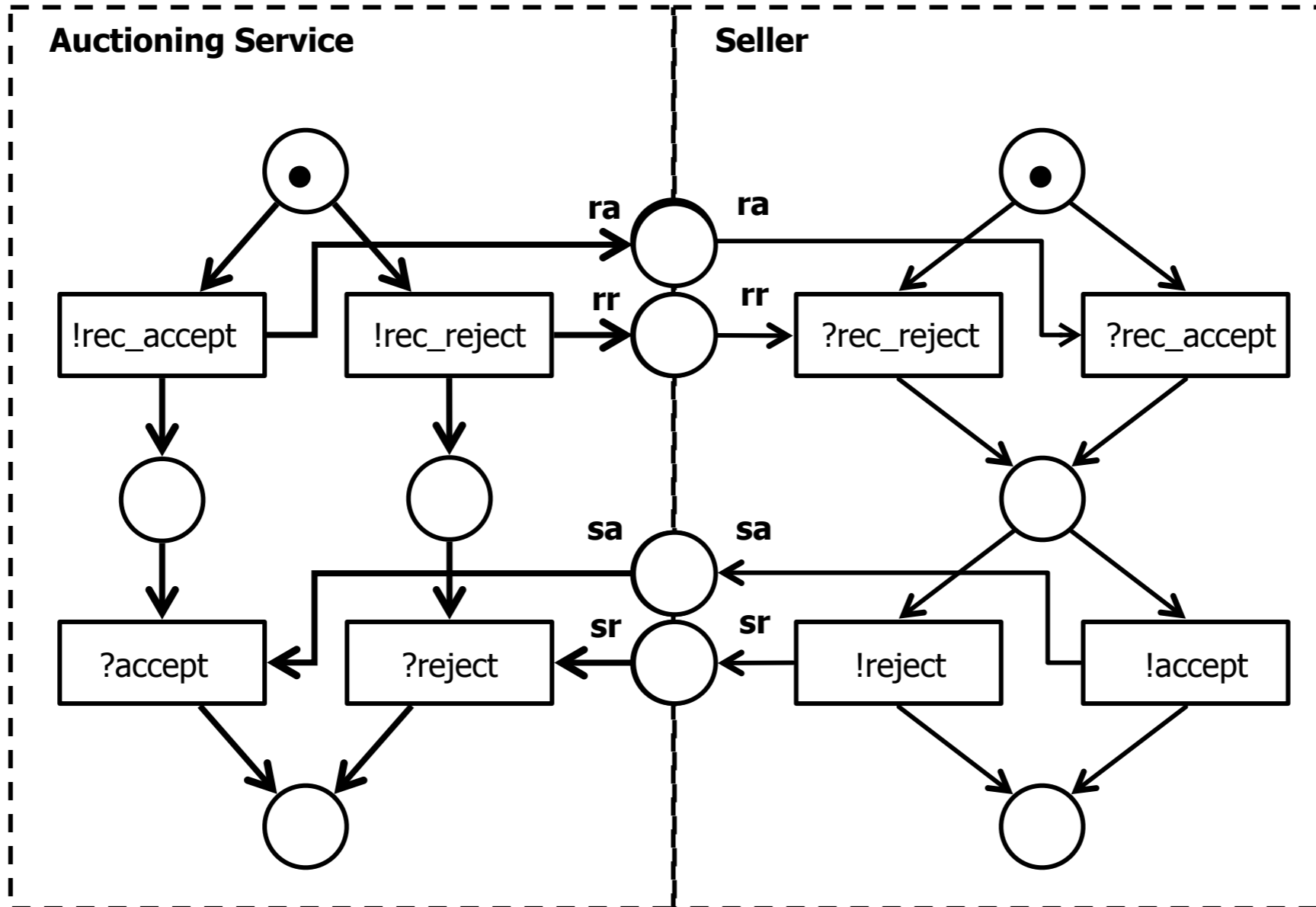
for every message that can be received
there is exactly a module who can send it

(formats of message data are assumed to match)

Compatibility



Interaction



Problem

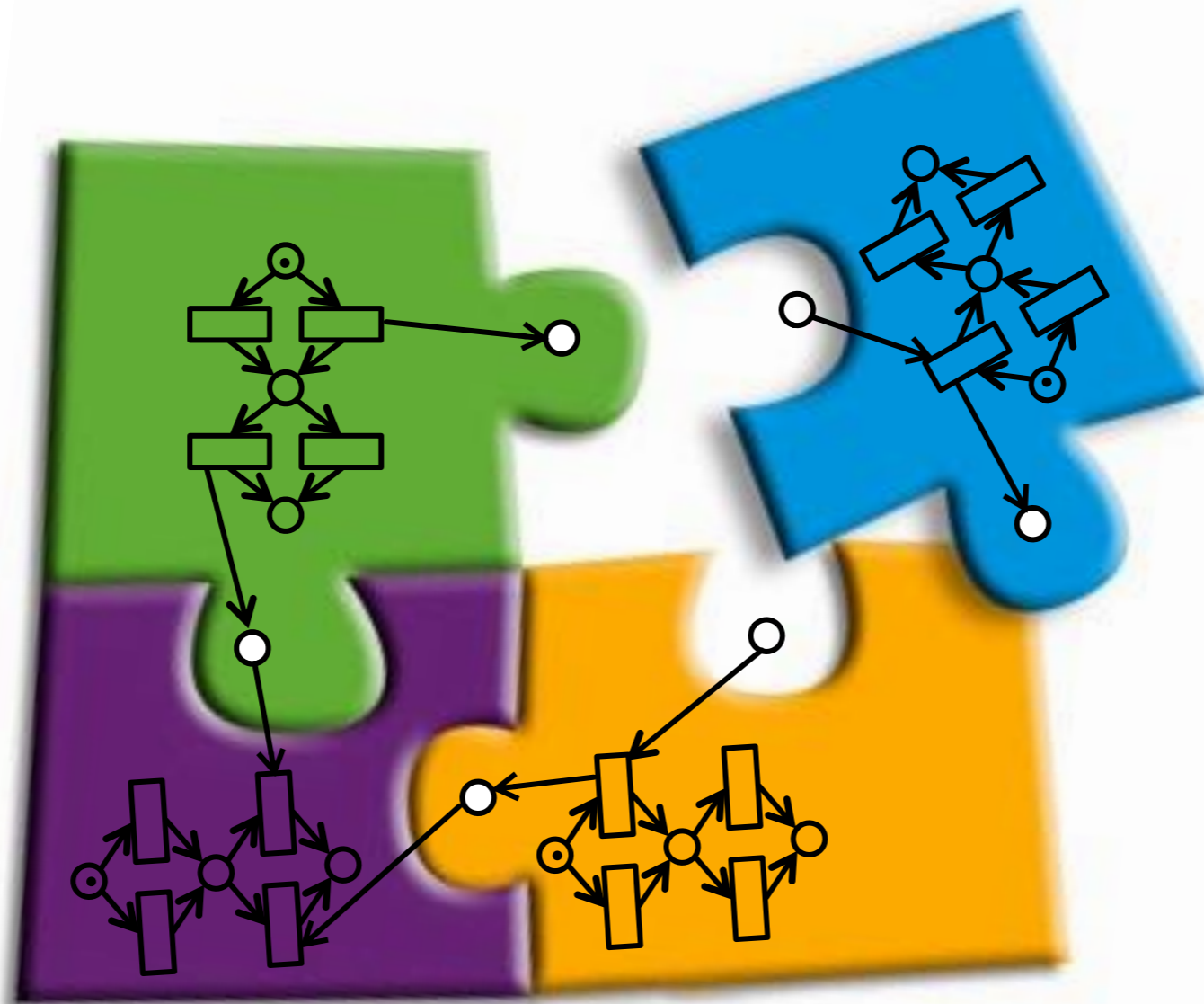
We have added places and arcs to single wf nets

We have joined places of different wf modules

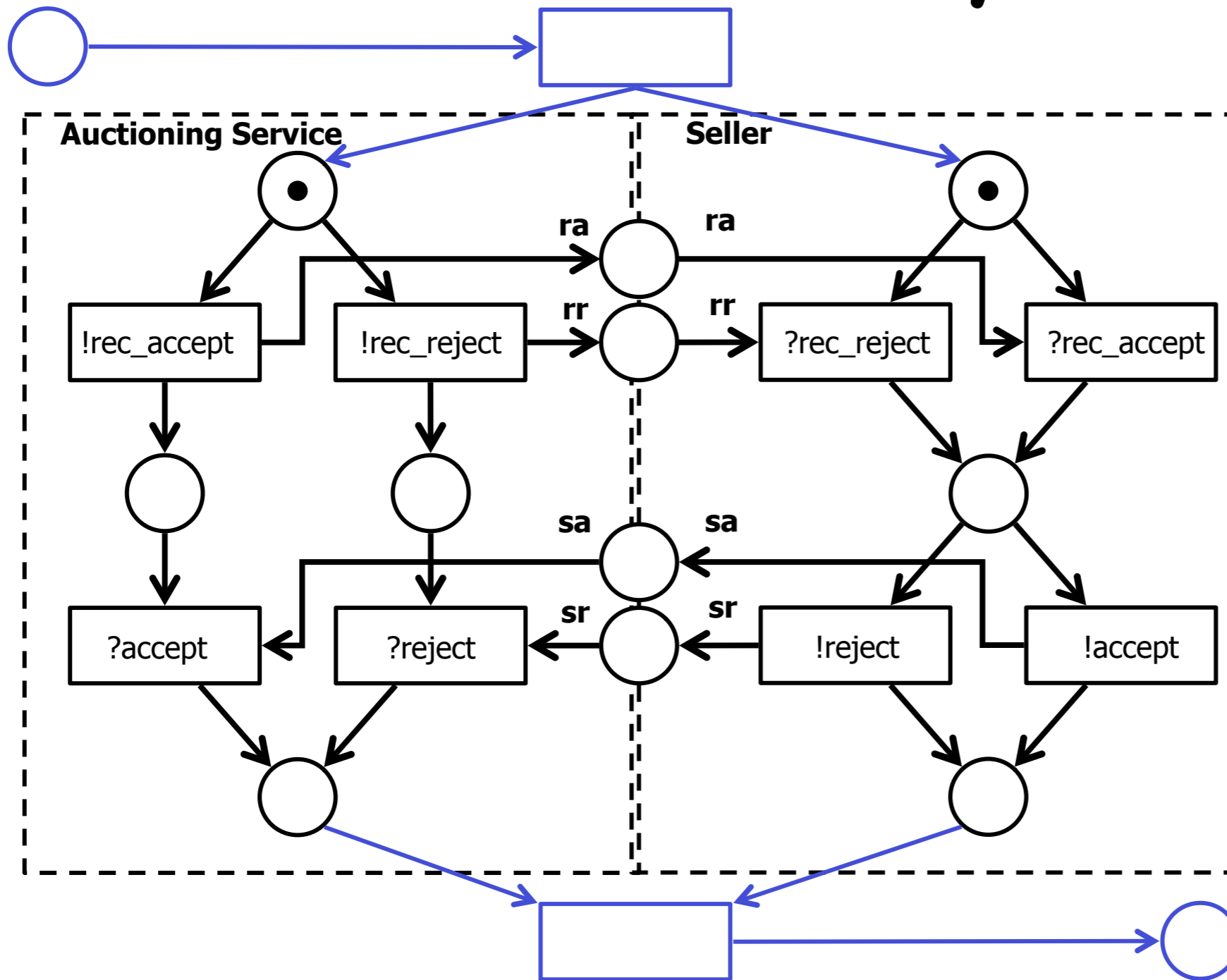
How do we check that the system behaves well?

What has this check to do with WF net soundness?

Workflow systems



Workflow system



Workflow system

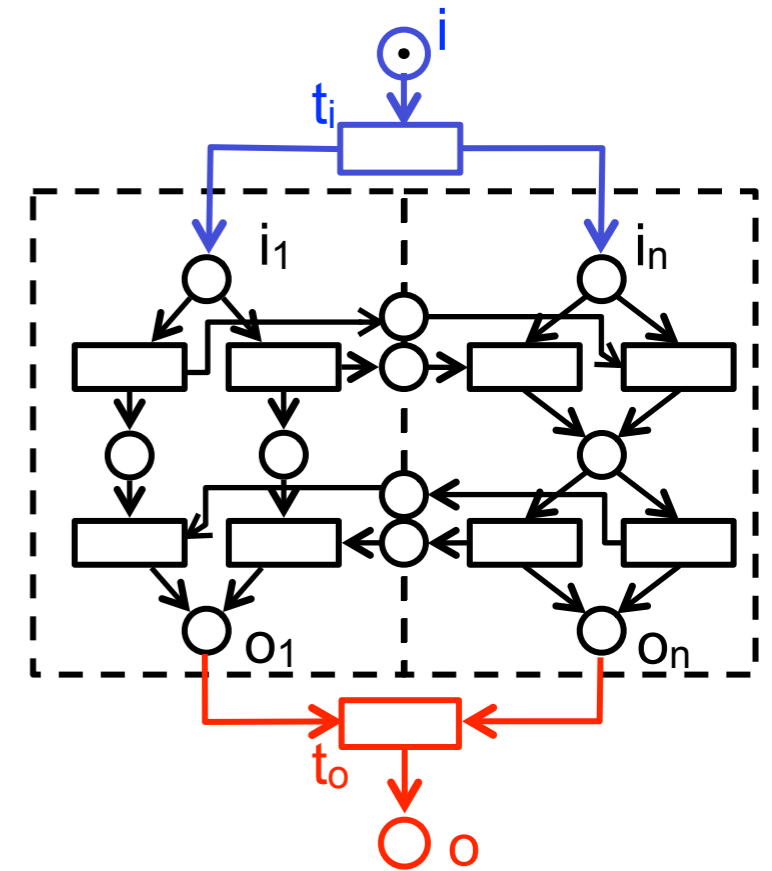
Definition: A **workflow system** is a wf net that consists of

a set of n structurally compatible wf modules
(initial places i_1, \dots, i_n , final places o_1, \dots, o_n)

plus an initial place i
and a transition t_i from i to i_1, \dots, i_n

plus a final place o
and a transition t_o from o_1, \dots, o_n to o

whose initial marking is i



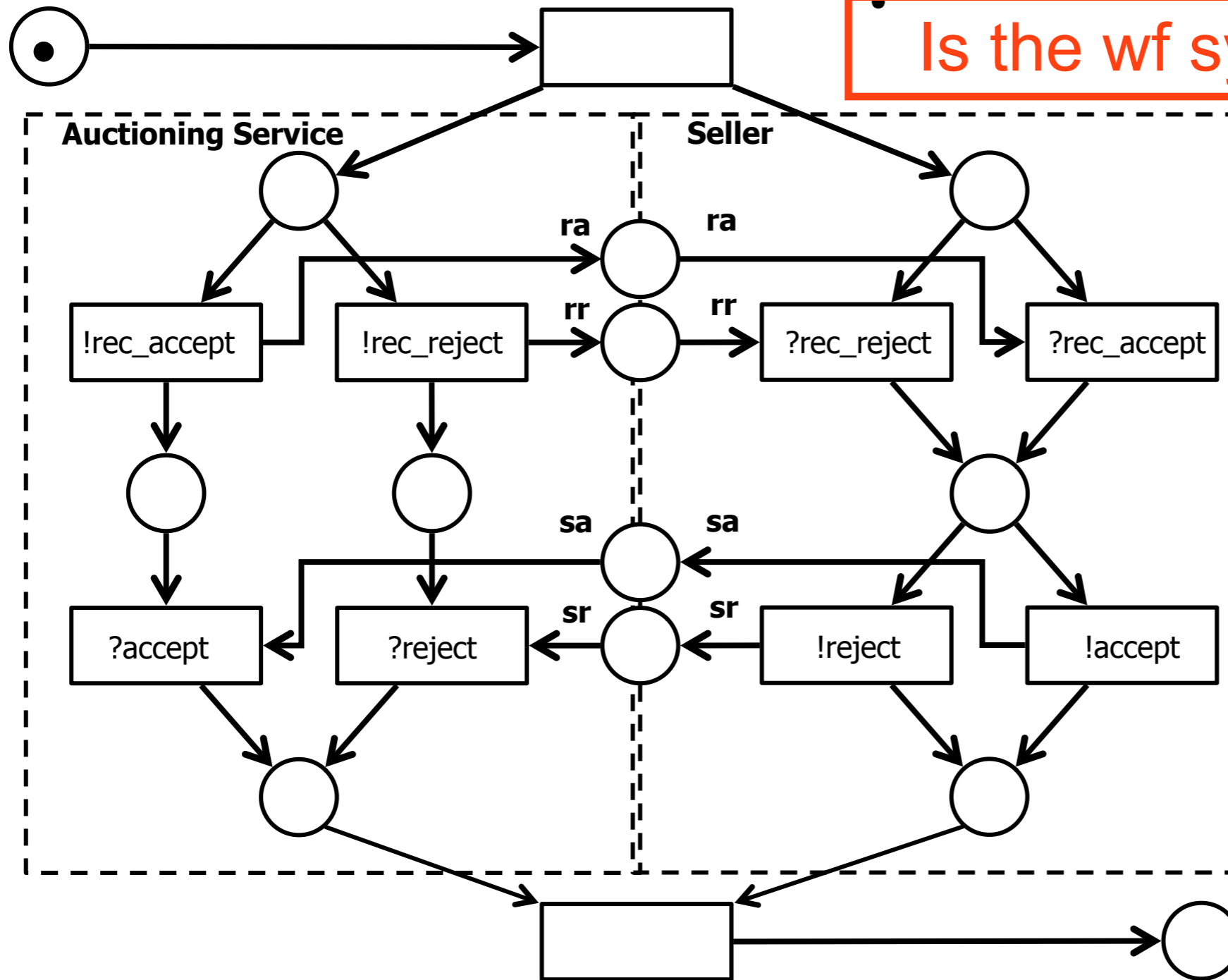
Soundness of workflow systems

A workflow system is just an ordinary workflow net

We can check its **soundness** as usual

Example

Is the wf system sound?



Example

The screenshot displays a BPEL preview tool window titled "wfmodules-auctioning1.pnml". The main area shows a Petri net diagram representing a workflow. A red box highlights the text "not sound!" in red. The diagram includes a start node, a transition labeled "start", and several places (p6, p7, p8, p14) and transitions (lrec accept, lrec reject, rrec reject, rrec accept, ?accept, ?reject, !accept, !reject). The diagram is annotated with "auctioning service" and "seller".

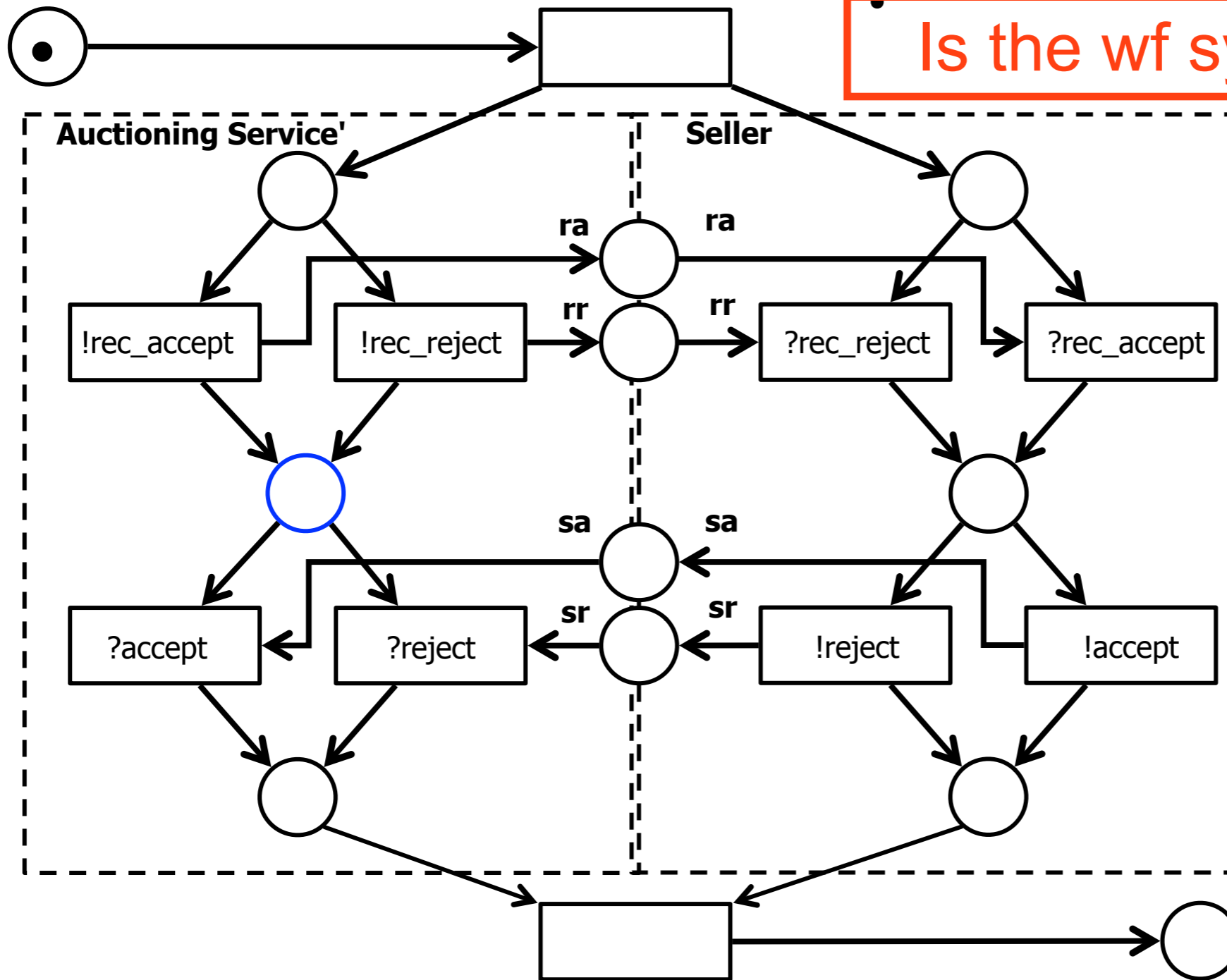
The right panel, titled "Semantical analysis", shows the following results:

- Qualitative analysis
 - Structural analysis
 - Net statistics
 - Wrongly used operators: 0
 - Free-choice violations: 1
 - Free-choice violation group 1
 - S-Components
 - Wellstructuredness
 - PT-Handles: 10
 - TP-Handles: 10
- Soundness
 - Workflow net property
 - Initial marking
 - Boundedness
 - Liveness
 - Dead transitions: 0
 - Non-live transitions: 10

The bottom status bar shows "Horizontal", "Zoom: 90%", and "Saved".

Example

Is the wf system sound?



Example

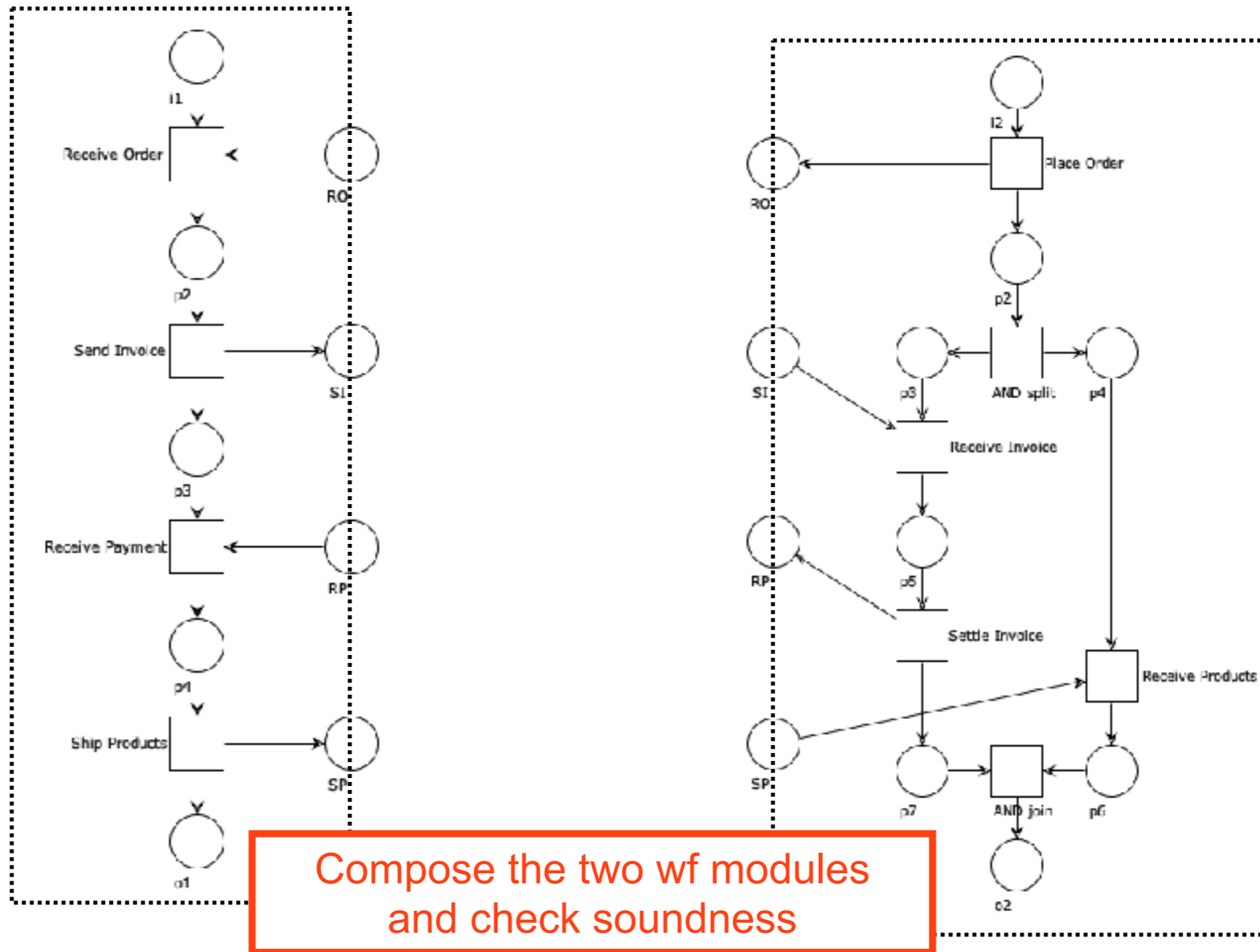
The screenshot displays a BPMN editor window titled "wfmodules-auctioning2.pnml". The main area shows a process diagram with a start node, an "auctioning service" pool, and a "seller" pool. The diagram includes various activities and transitions, with a blue box highlighting the word "sound!".

On the right, the "Semantical analysis" panel is open, showing the following results:

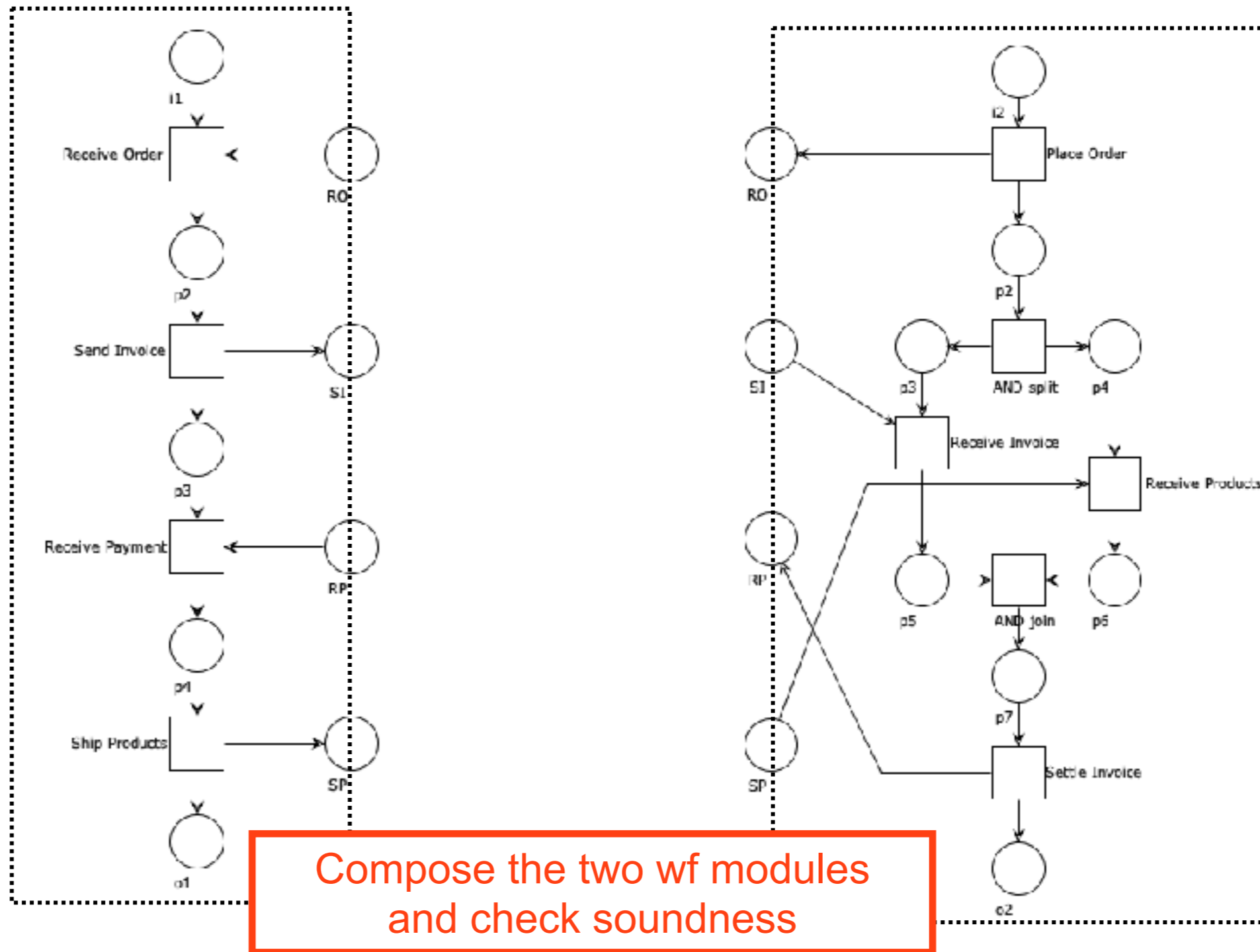
- Qualitative analysis
 - Structural analysis
 - Net statistics
 - Wrongly used operators: 0
 - Free-choice violations: 2
 - Free-choice violation group 1
 - Free-choice violation group 2
 - S-Components
 - Wellstructuredness
 - PT-Handles: 12
 - TP-Handles: 12
 - Soundness
 - Workflow net property
 - Initial marking
 - Boundedness
 - Liveness

The bottom of the window shows "Horizontal" orientation, "Zoom: 90%", and a "Saved" status.

Exercise



Exercise



Weak soundness

Problem

When checking behavioural compatibility
the soundness of the overall net
is a too restrictive requirement

Workflow modules are designed separately,
possibly reused in several systems
It is unlikely that every functionality they offer is
involved in each system

Problem

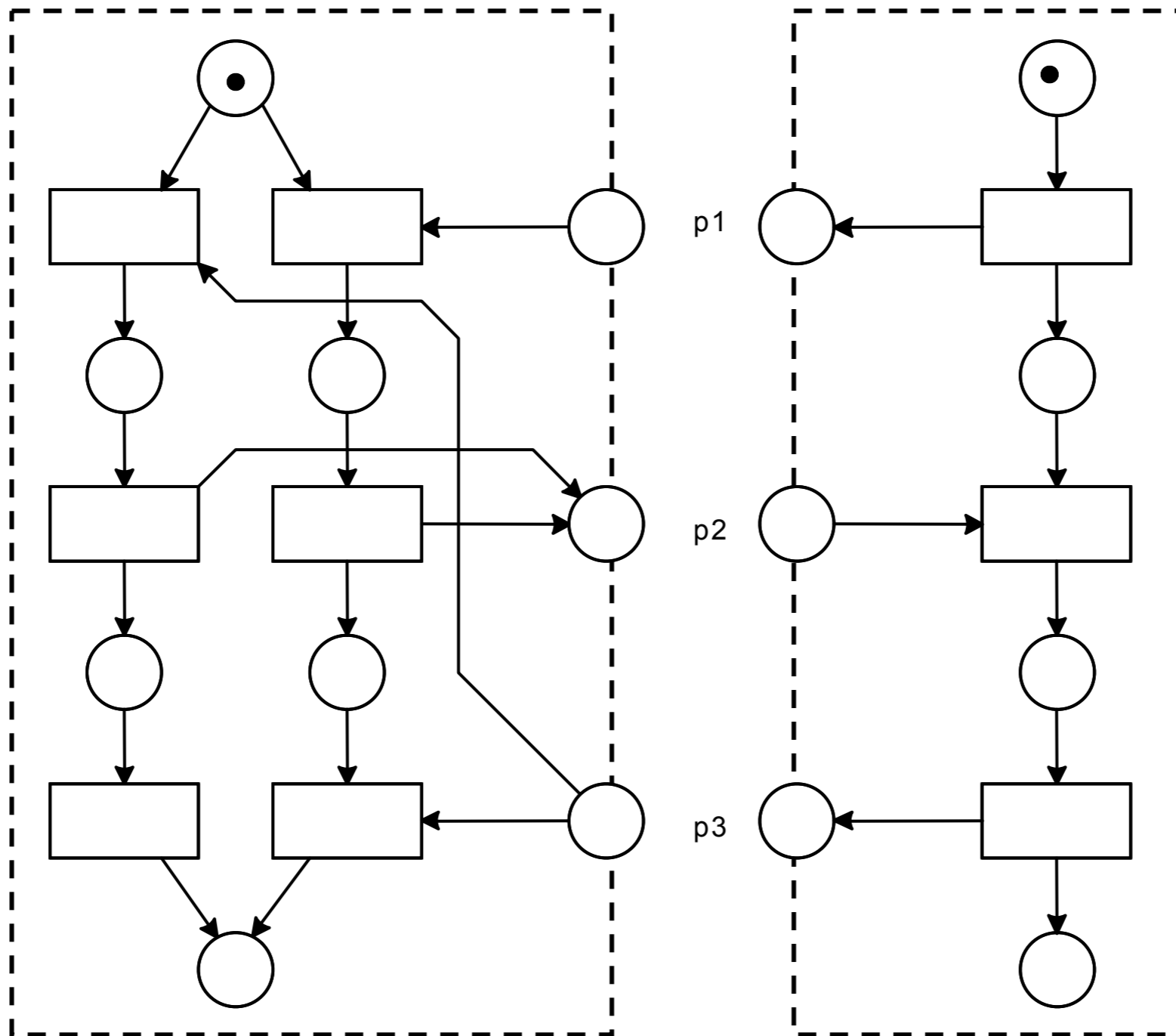
Definition: A workflow net is **weak sound** if it satisfies “option to complete” and “proper completion”

(dead tasks are allowed)

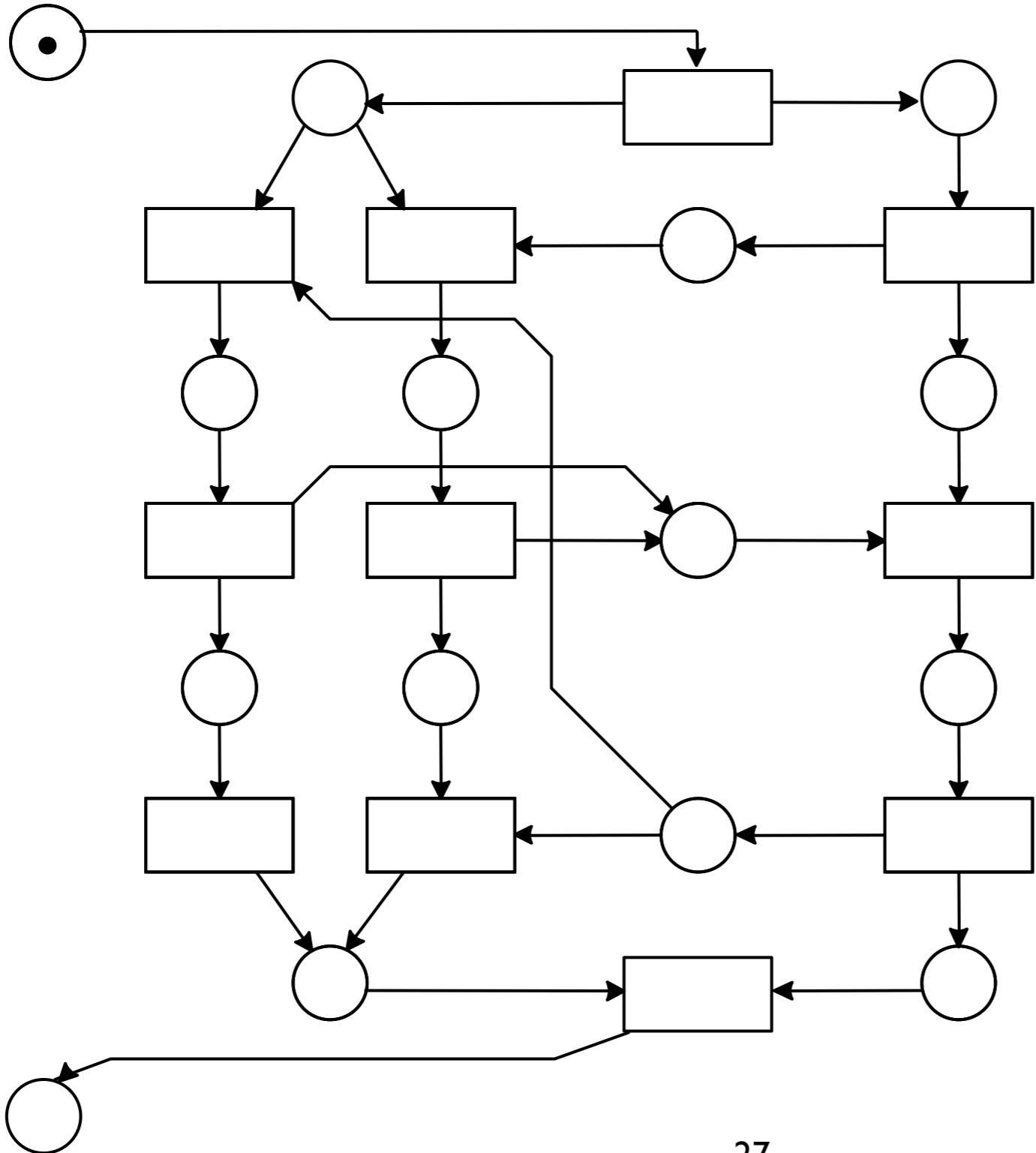
Weak soundness can be checked on the RG

It guarantees deadlock freedom and proper termination of all modules

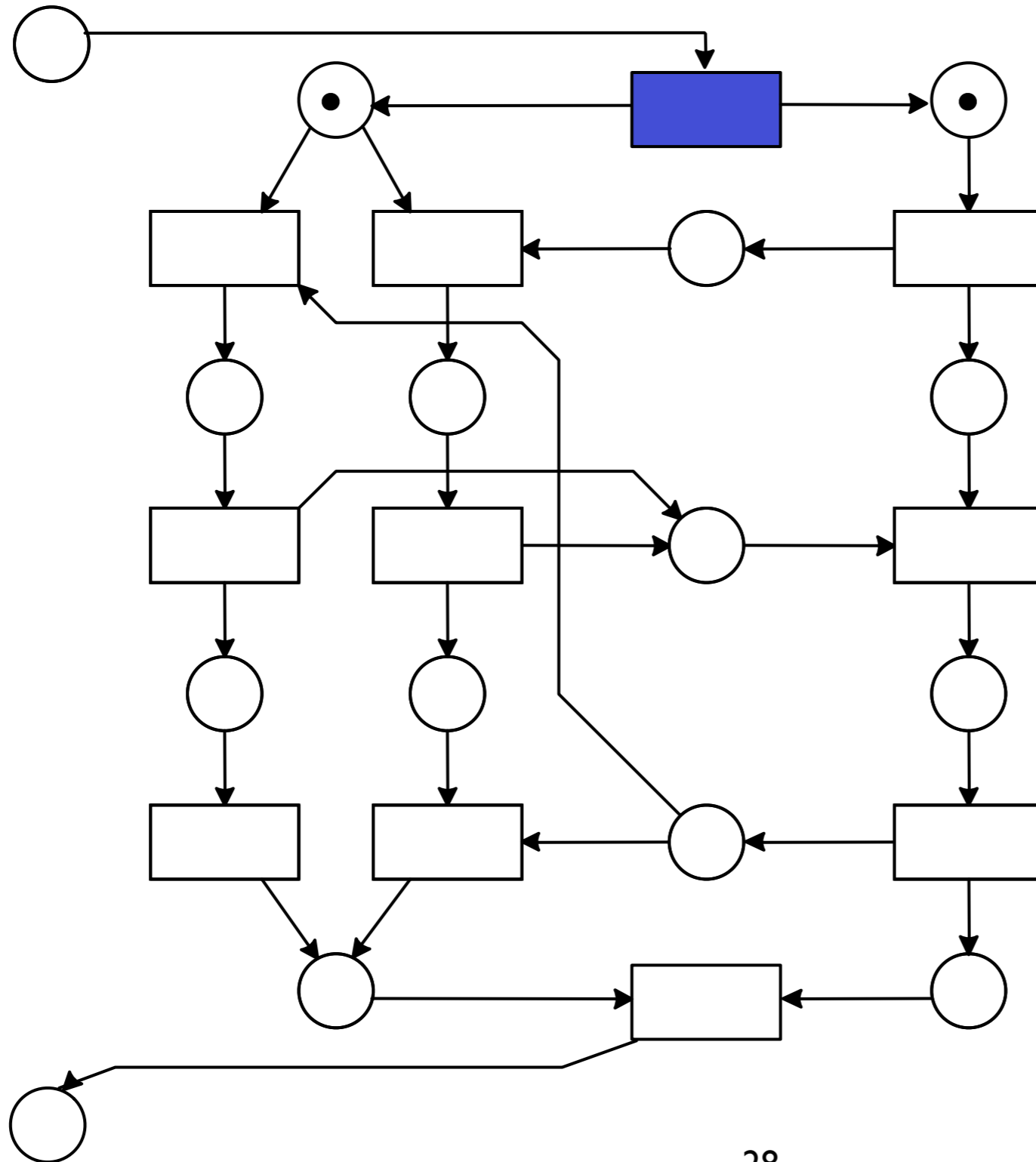
Sound + Sound = ?



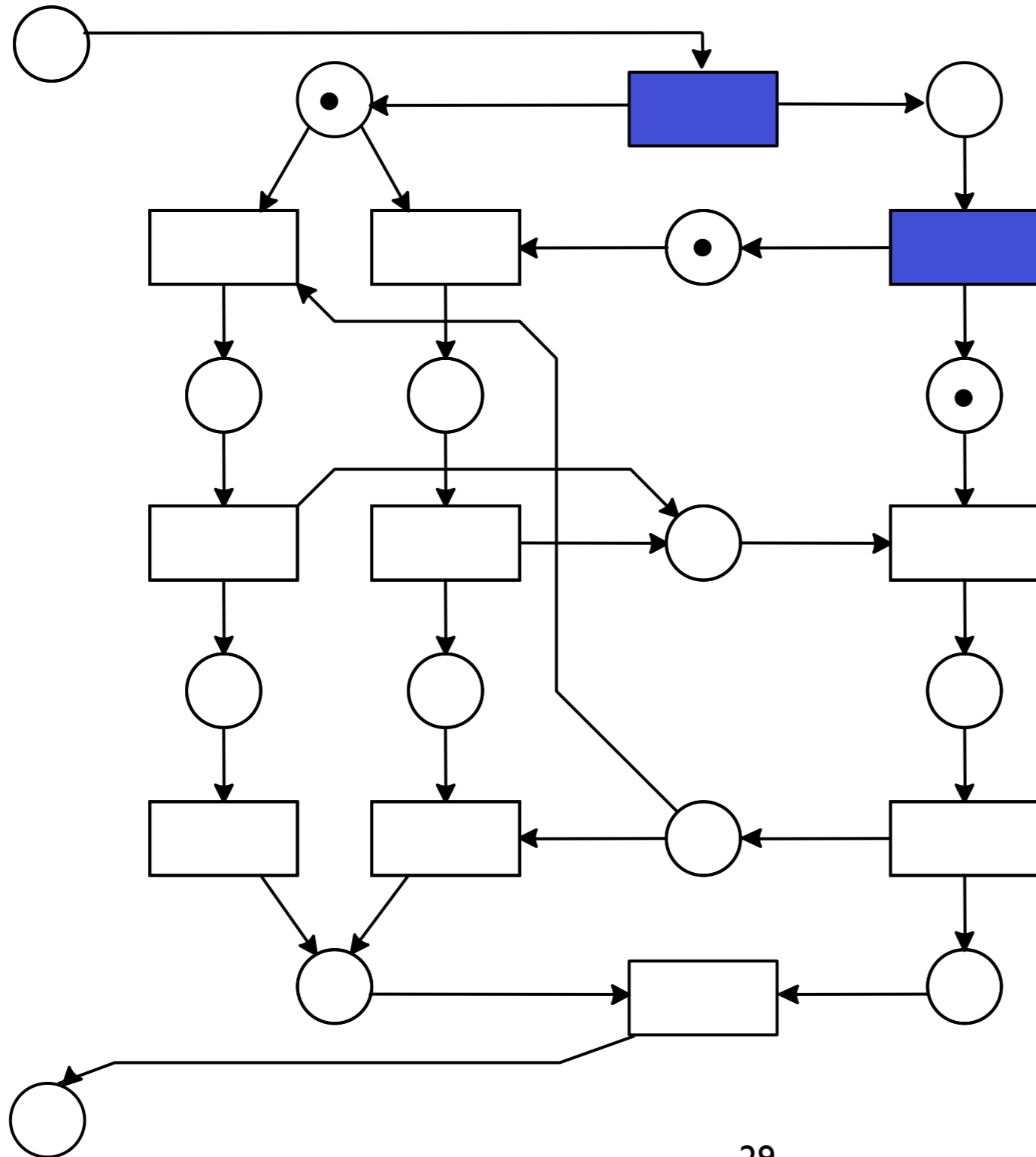
Sound + Sound = not sound



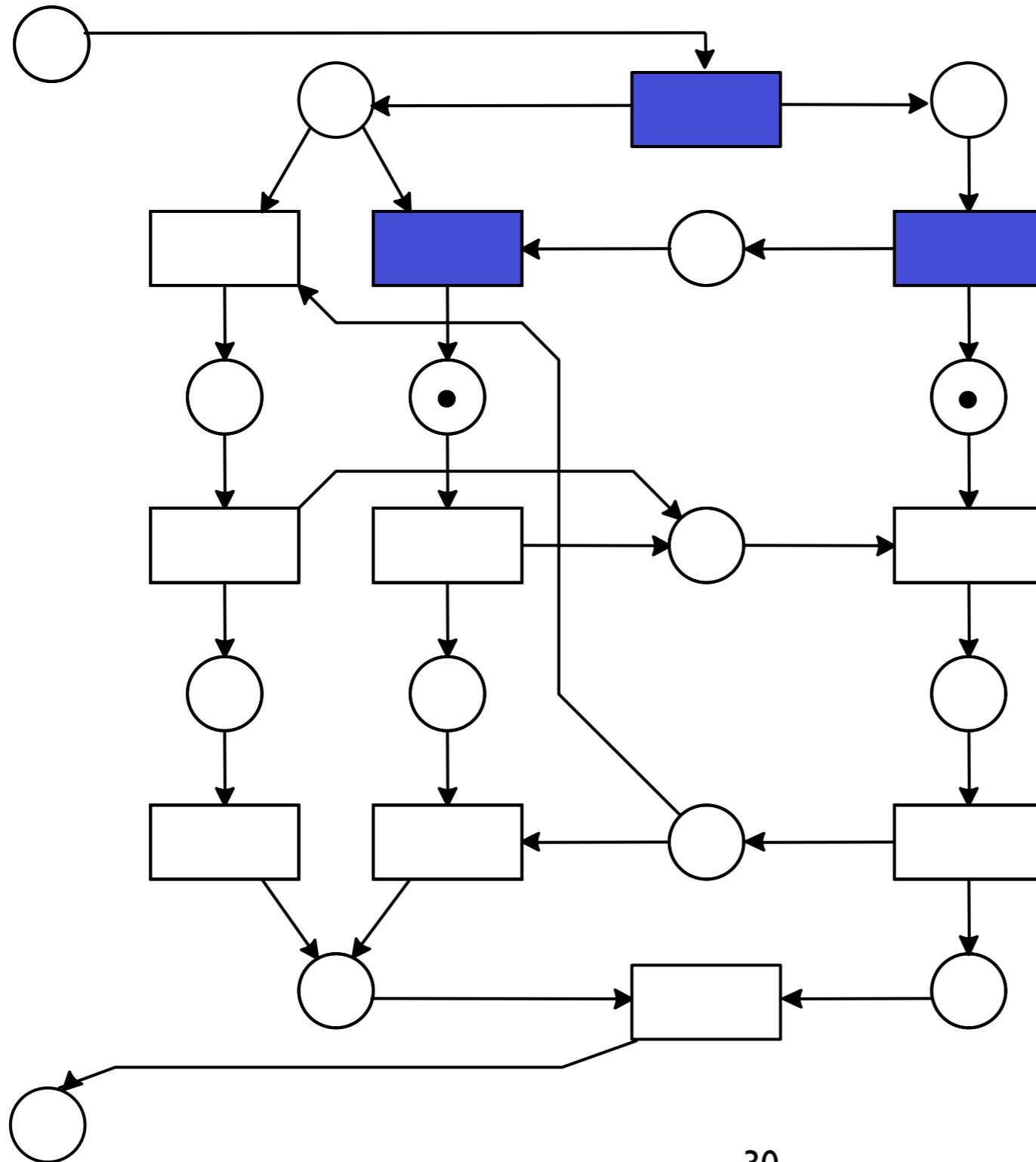
Sound + Sound = not sound



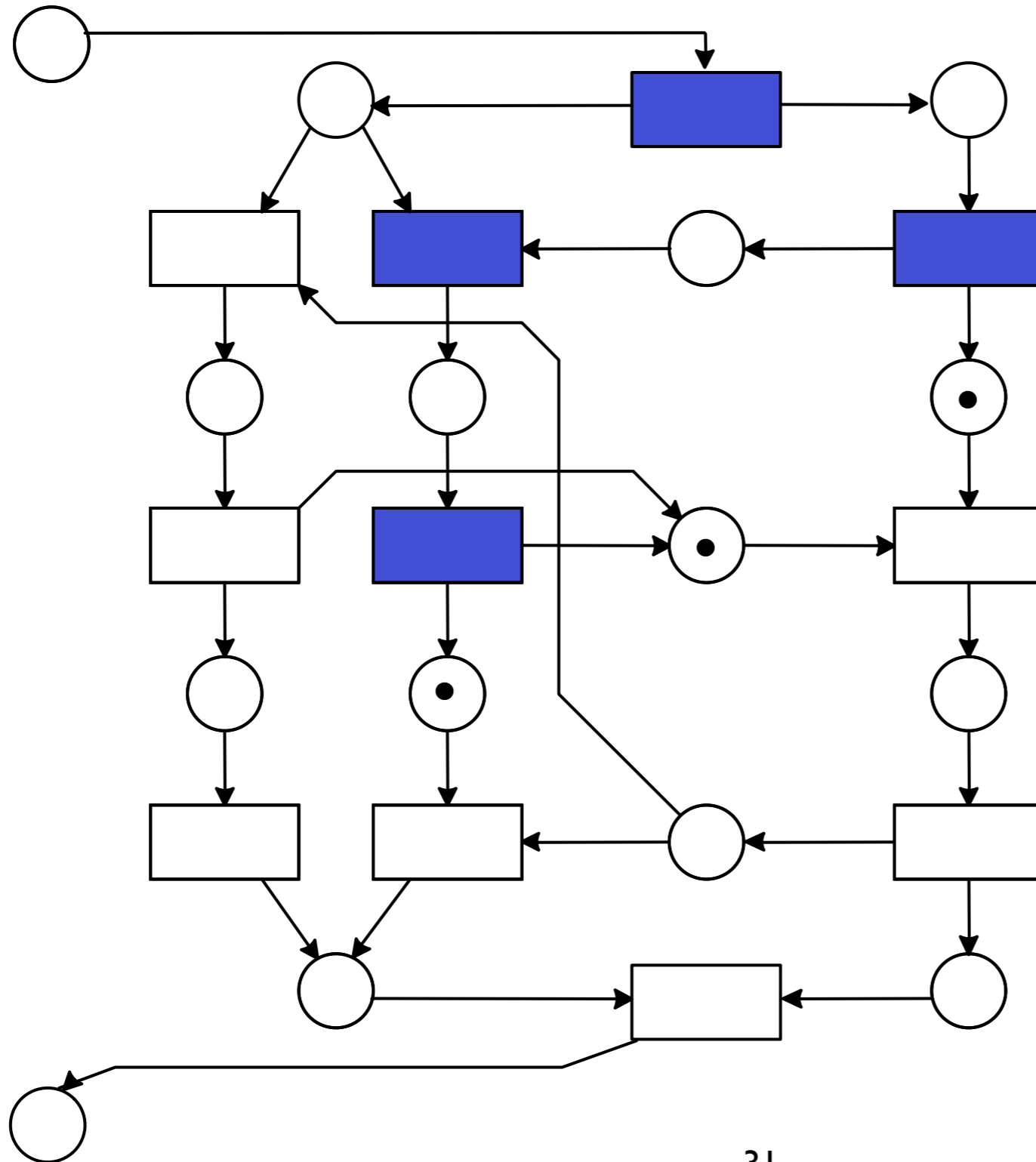
Sound + Sound = not sound



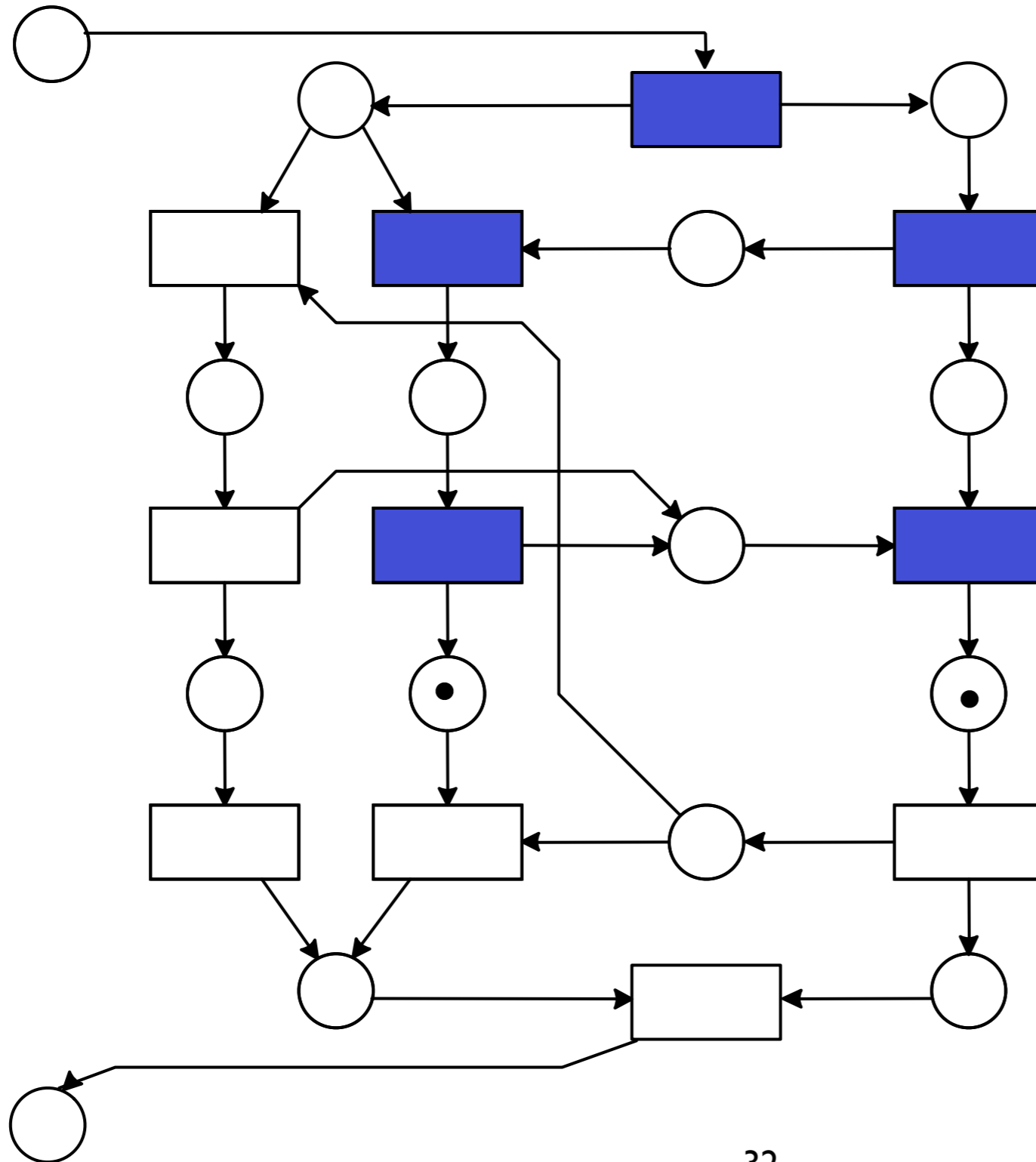
Sound + Sound = not sound



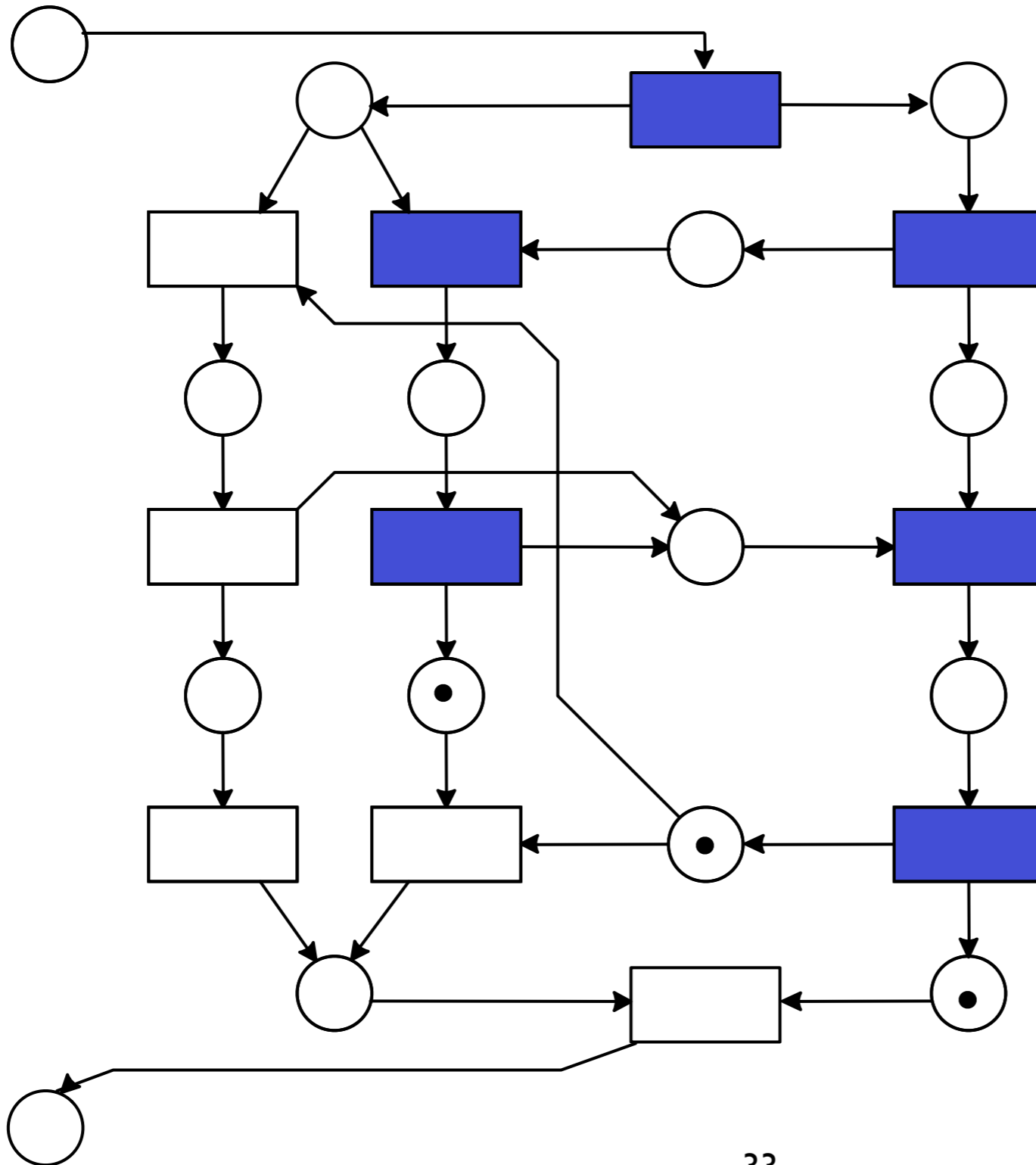
Sound + Sound = not sound



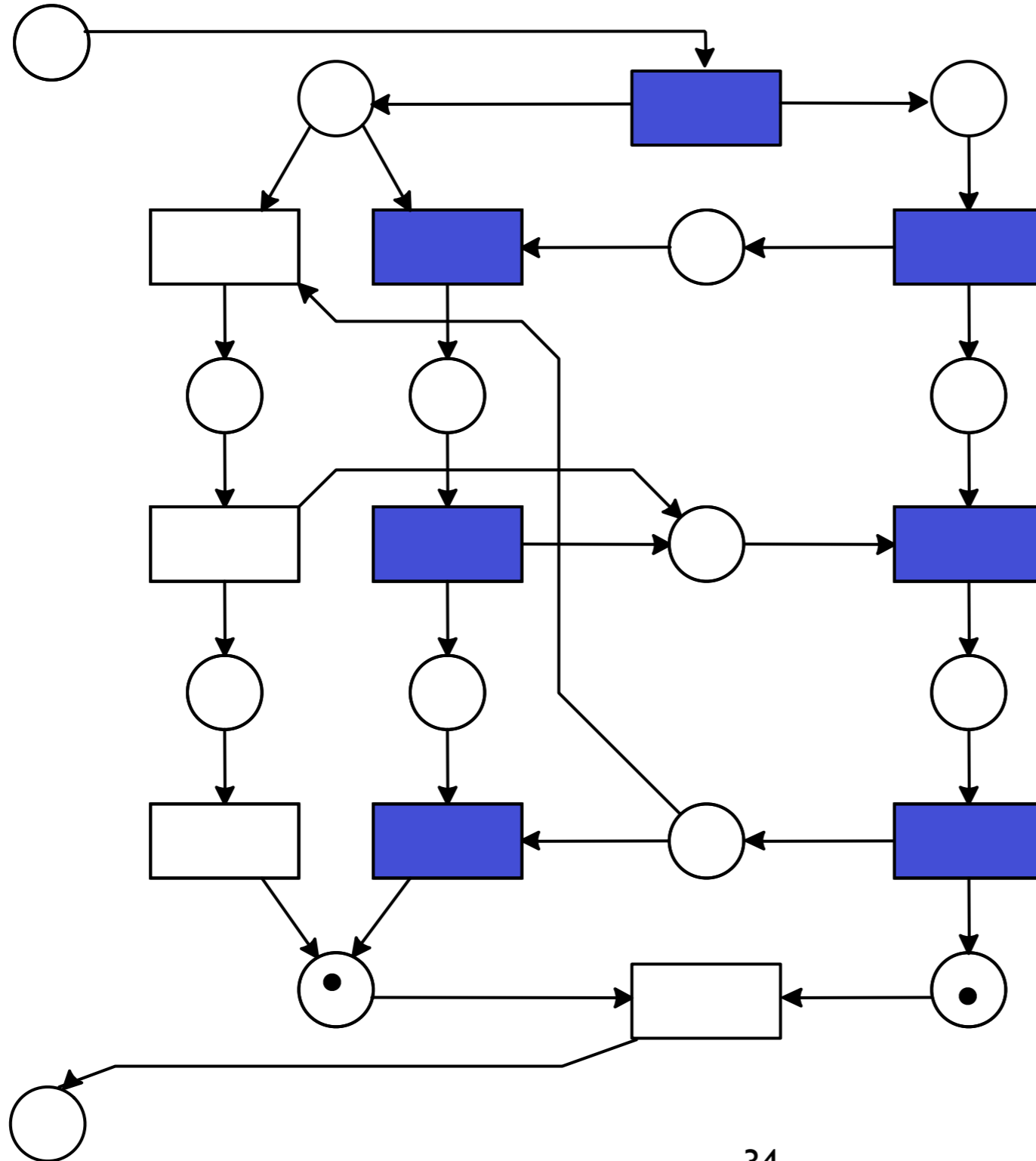
Sound + Sound = not sound



Sound + Sound = not sound

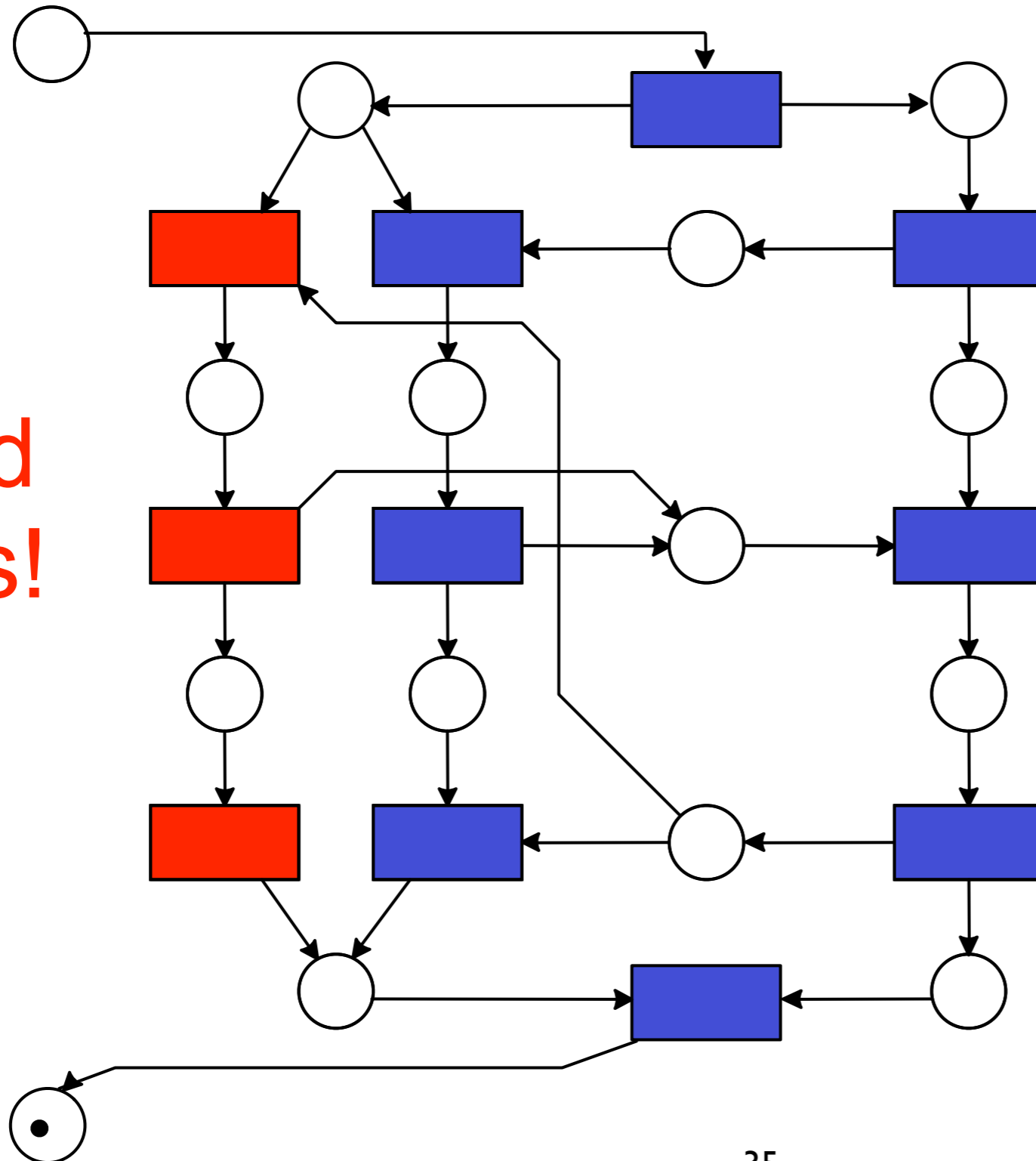


Sound + Sound = not sound

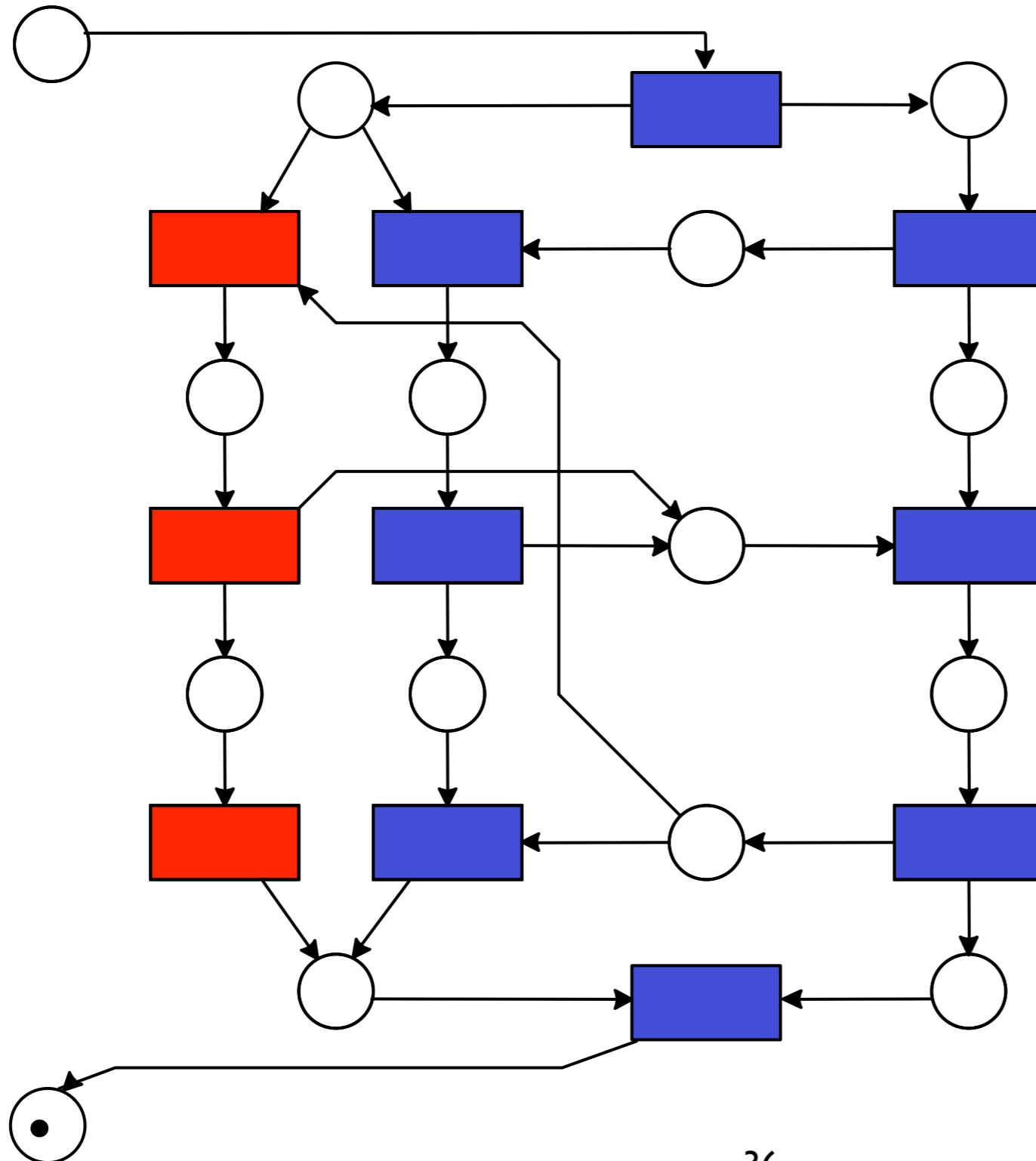


Sound + Sound = not sound

Dead tasks!



Sound + Sound = not sound



Weak
Sound!